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Simpson

INSTRUMENTS THAT STAY ACCURATE

260 Add-A-Tester Adapter

OPERATOR'S MANUAL

MICROVOLT ATTENUATOR MODEL 655

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Illinois, ES 9-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

New SIMPSON 260 "Add-A-Tester" Line

TRANSISTOR TESTER, Model 650 . . . . . $26.95
Beta Ranges: 0-10, 0-50, 0-250, (F.S.)
Beta Accuracy: ±3%, with 260 ±5% nominal
Ico Range: 0-100 ua
Ico Accuracy: ±1%, with 260 ±3% (F.S.)

DC VTVM, Model 651 . . . . . $32.95
Voltage Ranges: 0-.5/1.0/2.5/5.0/10/25/50/100/250/500
Accuracy: ±1%, with 260 ±3% (F.S.)
Input Impedance: greater than 10 megs all ranges

TEMPERATURE TESTER, Model 652 . . . $38.95
Temperature Ranges: −50°F to +100°F, +100°F to +250°F
Accuracy: with 260 ±2° (nominal)
Three lead positions provided
Sensing Element: thermistor

AC AMMETER, Model 653 . . . . . $18.95
Ranges: 0-0.25/1/2.5/12.5/25 amps
Accuracy: ±1%, with 260 ±3% nominal
Frequency Range: 50 cycles to 3000 cycles

AUDIO WATTMETER, Model 654 . . . . . $18.95
Load Ranges: 4,8,16,600 ohms
Wattage: Continuous 25 watts (8,600 ohms)
50 watts (4,16 ohms)
Intermittent 50 watts (8,600 ohms)
100 watts (4,16 ohms)
Accuracy: ±5%, with 260 ±10% nominal
Direct reading scale from 17 microwatts to 100 watts

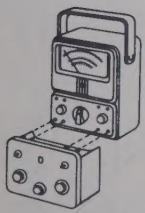
MICROVOLT ATTENUATOR, Model 655 . $18.95
Ranges: 2.5 microvolts to 250,000 microvolts continuously variable in decade steps
Frequency: DC to 20 KC
Accuracy: ±1db

BATTERY TESTER, Model 656 . . . . . $19.95
Checks all radio and hearing aid batteries up to 90 volts at the manufacturer's recommended load, or any external load.

Note: All Simpson 260 Adapters provide for normal 260 usage without disconnecting the adapter.

OPERATOR'S MANUAL

MICROVOLT ATTENUATOR MODEL 655



Just plug it in

IMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Illinois, ES 9-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

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FIGURE 1 – SIMPSON MODEL 655, MICROVOLT ATTENUATOR.

OPERATOR'S MANUAL

SIMPSON – MODEL 655 ADAPTER

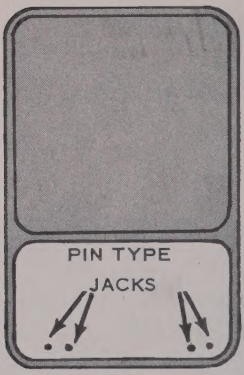
SECTION I

GENERAL DESCRIPTION

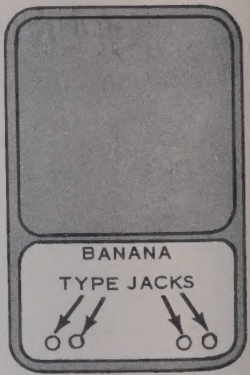
INTRODUCTION

The Simpson Microvolt Attenuator Model 655 is an accurate, compact, rugged instrument designed to provide a calibrated output from 2.5 microvolts to 250,000 Microvolts from DC or audio frequency power sources. When it is used in conjunction with a Simpson **260** * or **270** Multimeter, the source voltage is adjusted and measured, and then is attenuated in the Model 655 to an accurate low-level output. The Model 655 provides variable calibrated output voltages into a 600 ohm resistive load, at levels of −20 db to −100 db from the measured input. The frequency range is from DC through 20 kilocycles/sec.

*Trade Mark Registered U.S. Patent Office



(a) 260, Series II



(b) 260, Series III

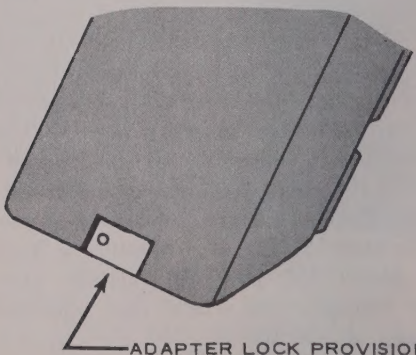


FIGURE 2 – 260* IDENTIFICATION

*Trade Mark Registered U. S. Patent Office

GENERAL DESCRIPTION

The Simpson VOM-plus-adapter concept is completely unique in approach and versatility. Each of the adapter models, of which the Microvolt Attenuator is but one example, provides specific measurement and testing capabilities at a fraction of the cost normally required for separate testers.

ACCESSORIES FURNISHED

Each instrument is furnished with an Operator's Manual and four extra pin-type plugs. The four pin-type plugs are used only when the Model 655 is to be used together with a **260** Series II (see figure 2 for **260** Series II and Series III identification).

Test leads are not furnished with the Model 655. If you do not have a pair of test leads with banana plugs, obtain them for use with the instrument; the Simpson Part Number for a pair of leads is 10–837500 (also see page 5).

SPECIFICATIONS

Input: Normal: 0 – 2.5 volts (DC to 20 KC/sec.)

Maximum: 33 volts (DC to 20 KC/sec.)

Input Impedance: 2000 ohms resistive

Frequency response: essentially flat from DC to 20 KC/sec.

*** Output:**

Ranges: 0 – 25 microvolts
0 – 250 microvolts
0 – 2.5 millivolts
0 – 25 millivolts
0 – 250 millivolts

Accuracy:

Adapter only ± ½ DB
Adapter with **260** or **270** ± 1 DB (nominal)

*** NOTE**

For inputs greater than 2.5 volts, the 655 output will be equal to the Meter reading multiplied by an attenuation factor as determined by the range switch setting. See page 11.

Output Impedance: 600 ohms resistive

Power Input: none required.

Size: 5-5/16 x 4-3/8 x 3-7/16 inches

Weight: 1 pound, 4 ounces.

MODIFICATION KITS

Adapter Case Kit 401 for 260 Series III and 270.

Use of this kit is optional. The kit converts the **260** Series III or the **270** VOM produced prior to June 1, 1959. It consists of a modified case which permits latching the Model 655 securely to the multimeter.

Adapter Case Kit 402 for 260 Series II.

Use of this kit is optional for this adapter. It includes a modified case which permits latching the Model 655 securely to the underside of the multimeter, and also provides a 50 μA D.C. current range for the **260.** The 50 microampere range is required for other Adapter Models.

CONTROLS AND CONNECTORS

METER ADJUST

The METER ADJUST control at the left on the front panel is used to adjust the Model 655 input voltage to the desired level.

FULL SCALE OUTPUT

This is a six-position rotary switch at the right on the front panel. The switch positions are marked 25 μV, 250 μV, 2.5 MV, 25 MV, 250 MV, and 260

DIRECT. It is used as a range switch and as a function switch.

When the switch is set at any of the positions marked with a μV or MV value, and the input voltage is set from 0 to 2.5 volts, the Model 655 output can be read directly with the 2.5 volt range of the meter. If the input voltage is A.C., use the arc marked 2.5 V.A.C. ONLY; if the voltage is D.C., use the arc marked from 0 to 250 D.C. For both applications, place the decimal point in the reading according to the 655 range position; the value indicated at the switch position used stands for full scale deflection on the VOM.

When the switch is set at 260 DIRECT, the VOM may be used without detaching the Model 655. The COM. – and + jacks at the left on the front panel of the Model 655 are connected through to the corresponding terminals on the VOM.

INTERNAL 600Ω LOAD

The slide switch has two positions, marked IN and OUT. It controls connection of the 600 ohm load in the Model 655 circuits. When the output is connected to a high impedance circuit, the internal 600 ohm load serves as the proper termination for the attenuator. When it is not required, it may be switched out of the circuit.

260 – 655 INPUT JACKS

The 260 – 655 INPUT jacks are located at the left on the front panel. They are marked COM. – and + and are used for connecting the test leads for all inputs into the Model 655 and into the VOM while the Model 655 is attached to it.

655 OUTPUT JACKS

The 655 OUTPUT jacks are located at the lower right on the front panel. One jack is marked COM. –, and the other jack is unmarked. The COM. – jack is connected through to the Model 655 COM. – INPUT jack on the left.

SECTION II

OPERATING INSTRUCTIONS

1. Initial Adjustments

a. 260/270 Control Settings.

1. With the Model 655 disconnected, check the meter pointer position for zero indication with the VOM in its operating position. If the pointer is off zero, adjust the bakelite screw just under the meter. Refer to the VOM Operator's Manual for this adjustment.

2. Set the **260/270** for either AC or + DC operation, according to the voltage source which is to be attenuated.

3. Set the **260/270** range switch to the 50 V position.

b. Connecting the Model 655 to the 260/270.

1. Insert the top four plugs of the Model 655 into the lower four jacks of the **260/270.**

2. Position the adapter locking latch, underneath the instrument, to secure the two units.

CAUTION

If your **260/270** case does not have the locking provision, avoid applying excessive pressure to the top of the Adapter when it is connected to the VOM used in the Adjust-A-Vue position. A modification kit which includes a new case with an adapter lock provision is recommended for optimum rigidity (see page 5).

c. Model 655 Control Settings.

1. Set the METER ADJUST control fully clockwise.

2. Set the FULL SCALE OUTPUT switch at the 25 μV position.

3. Set the INTERNAL 600 Ω LOAD switch at the IN position.

2. Application of Source Voltage

a. **CAUTION:** Check the voltage source; be sure it does not exceed 33 volts across 2000 ohms.

b. Connect the voltage source to the 655 INPUT jacks.

c. Set the 655 input voltage to 2.5 volts using the voltage source output control and/or the 655 METER ADJUST control. Change the 260 volts range correspondingly, i.e., to 2.5 volts.

d. Set the 655 METER ADJUST control fully counterclockwise.

3. Applying Attenuated Output

a. Connect a test lead from the OUTPUT COM. – jack to the negative, or ground, side of the circuit where the voltage is to be applied. Connect another test lead from the other OUTPUT jack to the other side of the circuit.

CAUTION

If there is any DC voltage present in the circuit where an attenuated AC voltage is to be applied, use a series capacitor between the OUTPUT jack and the circuit connection. Use a capacitor with a value high enough to provide less than 50 ohms impedance at the frequency being used. For other circuit conditions, avoid parallel connections and use care in series connections.

b. Set the INTERNAL 600 Ω LOAD switch at the required position. See USE OF INTERNAL LOAD on page 11.

c. Set the 655 range switch at a position to include the desired output voltage.

d. Set the 655 METER ADJUST control for the desired output, as indicated on the **260**.

NOTE

For reading with increased accuracy, i.e. near full scale readings, inputs greater than 2.5 volts may be used. For these applications, the **260** range switch will be set on the 10 or 50 volt position, and the 655 output will be the **260** meter reading multiplied by an attenuation factor as determined by the 655 range switch setting. The attenuation

factor is a function of the range switch setting as follows:

Range Switch Setting	Attenuation Factor
25 microvolts	x .00001 (100 db)
250 microvolts	x .0001 (80 db)
2.5 millivolts	x .001 (60 db)
25 millivolts	x .01 (40 db)
250 millivolts	x .1 (20 db)

4. Using the VOM Circuit while the Model 655 is Attached

a. Set the FULL SCALE OUTPUT switch at 260 DIRECT.

b. Use the test leads connected to the 260 – 655 INPUT jacks at the left on the front panel. These jacks are connected internally to the corresponding jacks of the **260/270.** Proceed with the standard operating instructions for the VOM, according to its Operator's Manual.

USE OF INTERNAL LOAD

The internal 600 ohm load is provided for convenience when the Model 655 output is connected into a high impedance circuit, such as the control grid of a vacuum tube. When the resistance of the circuit into which the Model 655 output is connected is more than 60,000 ohms, set the

INTERNAL 600 Ω LOAD switch at IN; the resulting load will be substantially correct for the attenuator, and its accuracy will be as stated in the specifications (see page 4).

When the resistance of the circuit into which the Model 655 output is to be connected is less than 60,000 ohms but more than 600 ohms, set the INTERNAL 600 Ω LOAD switch at OUT and calculate the parallel resistance required to make the load appear as 600 ohms. Use the formula

$$X = \frac{600\,R}{600 - R}$$

where X = the resistance to be connected in parallel

and R = the resistance present in the circuit.

For example: if the circuit has 3000 ohms of resistance, the above formula would then be used to calculate the parallel resistance as follows:

$$X = \frac{600 \times 3000}{2400} = 750 \text{ ohms}$$

Thus, a 750 ohm resistor would be connected in parallel with the circuit, and the Model 655 internal load would not be used.

When the input impedance of the external circuit is 600 ohms, set the INTERNAL 600 Ω LOAD switch at OUT. The circuit is proper for the Model 655.

When the input impedance of the external circuit is less than 600 ohms, set the INTERNAL 600 Ω LOAD switch at OUT, and connect sufficient series resistance to increase the load resistance to 600 ohms. Voltage across the load is then a proportional part of the Model 655 output voltage. To calculate the voltage across the load, use the formula.

$$E = \frac{R}{600}(E_o)$$

where E = voltage across the load,

R = resistance of the load,

and E_o = output voltage of Model 655.

SECTION III

THEORY OF OPERATION

GENERAL

The Model 655 Microvolt Attenuator sets and measures an input voltage and reduces it through an accurate ladder attenuator to a known low level. When added to an audio or DC supply, it makes an excellent source of calibrated low voltage.

The 655 voltage input is applied across a potentiometer. This is the METER ADJUST control on the front panel. Any voltage up to 33 volts may be applied to the input. The output of the potentiometer is applied to the input of the ladder attenuator and is monitored by the VOM.

The output voltage of the ladder attenuator is determined by the FULL SCALE OUTPUT range switch. The switch position determines how many steps of the ladder attenuator are in the circuit. Each step attenuates the voltage 20 db (to 1/10 of its input level). When the input voltage is set at 2.5 volts, the attenuator (655) output is equal to the value marked at the range switch setting. When the input voltage is set at any other value, the output voltage can be calculated (see page 11).

All of the attenuator steps have resistances calculated on the basis of a 600 ohm termination. If any other load is connected across the output terminals, the 655 accuracy would be affected. It is recommended that the load resistance always be maintained at 600 ohms. For convenience, an internal 600 ohm load resistance is provided in the Model 655; when it is connected, with its switch set at IN, it is directly across the OUTPUT jacks, and is in parallel with any working load connected across the jacks.

SECTION IV

MAINTENANCE

CASE REMOVAL

To remove the instrument from its case, remove the four screws located in the four corners on the back of the instrument case. All of the components are attached to the front panel.

PARTS REPLACEMENT

All of the components of the Model 655 have been engineered for many years of useful life. However, there are conditions under which parts may become damaged or faulty, and require replacement. Refer to the circuit diagram in figure 3 to help identify and locate any suspected part.

In the event of any component failure, order replacement parts from Simpson Electric Company or from any of its Authorized Warranty Repair or Parts Stations. A list of these repair stations is included, beginning on page 18.

PARTS LIST

Description	Simpson Part Number
Resistor, 5400 ohms, ± 1%, ½ w	1–114528
Resistor, 5500 ohms, ± 1%, ½ w	1–115071
Resistor, 600 ohms, ± 1%, ½ w	1–117863
Resistor, 680 ohms, ± 1%, ½ w	1–115243
Potentiometer, 2000 ohms ± 30%, METER ADJ.	1–118219
Switch, FULL SCALE OUTPUT	1–118202
Switch, INTERNAL 600 Ω LOAD	1–118192
Knob	1–115548
Case, Adapter	10–680379

FIGURE 3 – MODEL 655 OVERALL SCHEMATIC DIAGRAM

SIMPSON WARRANTY REPAIR STATIONS AND PARTS DEPOTS

*California, Los Angeles ADams 2-4201
Quality Electric Company
3700 South Broadway
States: So. California below Fresno and Arizona

*California, San Francisco GArfield 1-7185
Pacific Electrical Instrument Lab.
111 Main Street
States: No. California above Fresno and Nevada

Canada
Bach-Simpson Ltd. GLadstone 1-9490
1255 Brydges Street
P.O. Box 484
London, Ontario, Canada

*Colorado, Denver RAce 2-8670
Meter-Master Instrument Service
2379 Downing Street
States: Wyoming, Utah, Colo. and New Mexico

*Georgia, Atlanta PLaza 3-4128
Electro-Tech Equipment
690 Murphy Avenue S. W.
States: Alabama, Georgia, Florida,
No. & So. Carolina, and Tenn.

*Illinois, Chicago COlumbus 1-1330
Pacific Indicator Company
5217 W. Madison Street
States: Chicago, Wisconsin and Indiana

*Louisiana, New Orleans TWinbrook 5-5621
Industrial Instrument Works
3328 Magazine Street
States: Arkansas, Mississippi and Louisiana

*Massachusetts, Cambridge UNiversity 4-2494
Alvin C. Mancib Company
363 Walden Street
States: Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island and Maine

*Michigan, Detroit LIncoln 7-1000
Ram Meter, Inc.
1100 Hilton Road, Ferndale
States: Michigan

*Minnesota, Minneapolis KEllogg 7-5411
Instrumentation Services
917 Plymouth Avenue
States: Minnesota, North and South Dakota

*Missouri, St. Louis FOrest 7-9799
Scherrer Instruments
5449 Delmar Blvd.
States: Illinois below Peoria, Iowa, Missouri, and Kansas

*Parts Depots

*New York, Buffalo EXport 2-2726
Electrical Instrument Labs.
1487 Hertal Avenue
States: New York State except Met. N. Y.

*New York 7, New York BArclay 7-4977
Simpson Instrument Service Corp.
27 Park Place
States: Metropolitan New York and New Jersey, above Trenton

New York, Syracuse HYatt 2-1651
Syracuse Instrument Lab.
2904 South Avenue

*Ohio, Cleveland CLearwater 1-4609
Weschler Electric Company
4250 W. 130th Street
States: Ohio and Kentucky

Oregon, Portland BElmont 4-6683
The Instrument Laboratory
1316 S.E. 7th Avenue

*Pennsylvania, Philadelphia ORchard 3-5600
Sunshine Scientific Instrument
1810 Grant Avenue
States: Penn. Md. New Jersey below Trenton, Virginia, W. Virginia, Washington, D.C., Delaware

*Parts Depots

*Texas, Dallas TAylor 4-2626
Nelson Electronic Eng. Co., Inc.
6329 Gaston Avenue
States: Oklahoma and Texas

Texas, Houston CApitol 8-2835
Nelson Electronic Eng. Co., Inc.
3615 Gulf Freeway

*Washington, Seattle ATwater 3-5850
The Instrument Laboratory, Inc.
934 Elliott Avenue West
States: Oregon, Washington, Idaho and Montana

*Parts Depots

Add-A-Tester Adapter

Model 651
DC VTVM

Designed for

TRANSISTOR CIRCUITRY
and GENERAL (AGC, Power
Supplies, etc.) SERVICING.

Laboratory Type DC
Coverage (10 ranges)

★

NET PRICE

$32.95

★

SIMPSON ELECTRIC COMPANY

5200 West Kinzie Street • Chicago 44, Illinois

WARRANTY

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

Quality is the indispensable component
of every Simpson instrument . . . . . .